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Land Use and Urban Development Project

RECOMMENDATIONS FOR LONG-TERM MONITORING

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The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART).

The program is being conducted by the Metropolitan Transportation Commission, a nine-county regional agency established by state law in 1970.

The program is financed by the U. S. Department of Transportation, the U. S. Department of Housing and Urban Development, and the California Department of Transportation. Management of the Federally funded portion of the program is vested in the U. S. Department of Transportation.

The BART Impact Program covers the entire range of potential rapid transit impacts, including impacts on traffic flow, travel behavior, land use and urban development, the environment, the regional economy, social institutions and life styles, and public policy. The incidence of these impacts on population groups, local areas, and economic sectors will be measured and analyzed. Finally, the findings will be interpreted with regard to their implications for the planning of transportation and urban development in the Bay Area and other metropolitan areas.

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BART IMPACT PROGRAM
LAND USE AND URBAN DEVELOPMENT PROJECT
RECOMMENDATIONS FOR LONG-TERM MONITORING

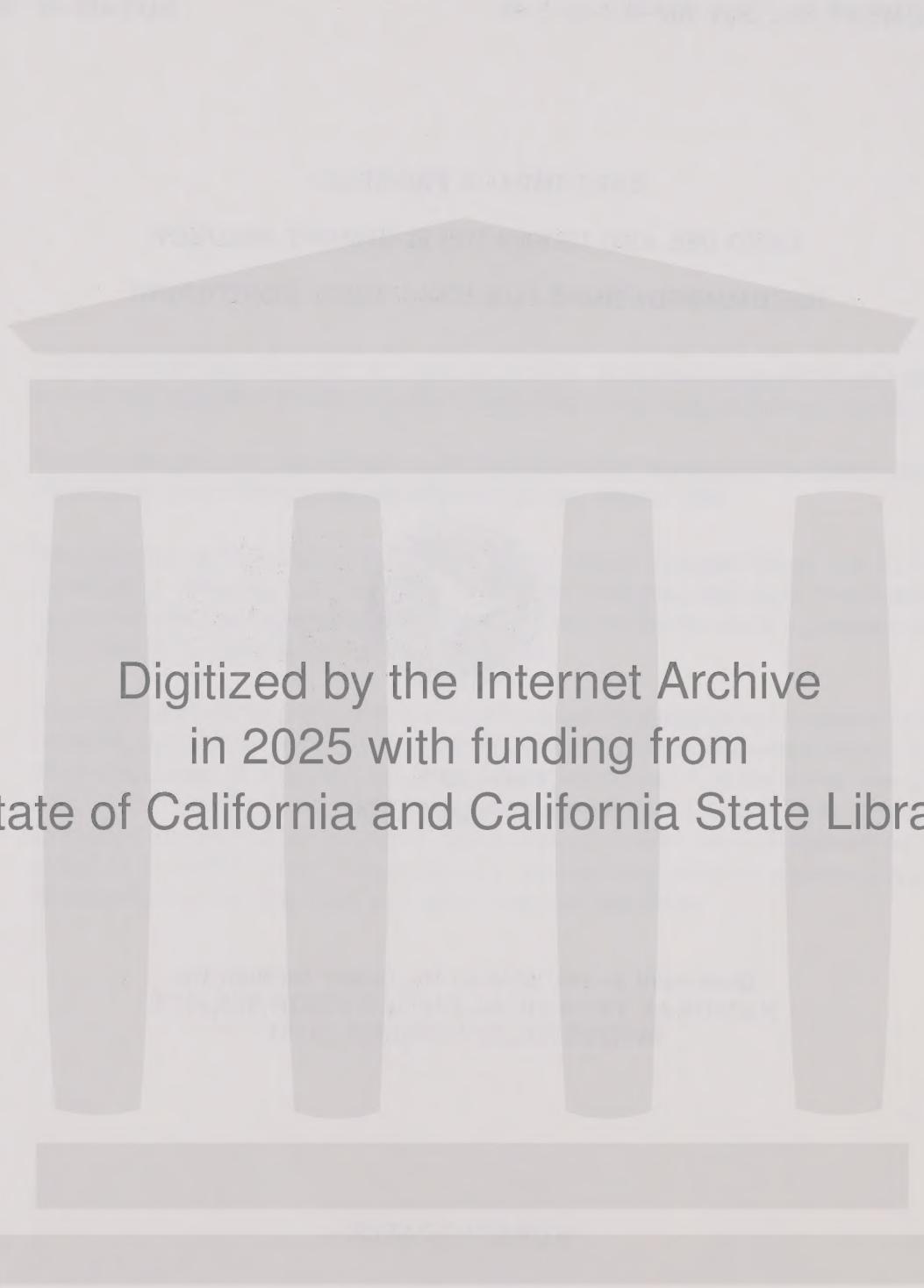


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WORKING PAPER

PREPARED FOR
U.S. DEPARTMENT OF TRANSPORTATION
AND
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT



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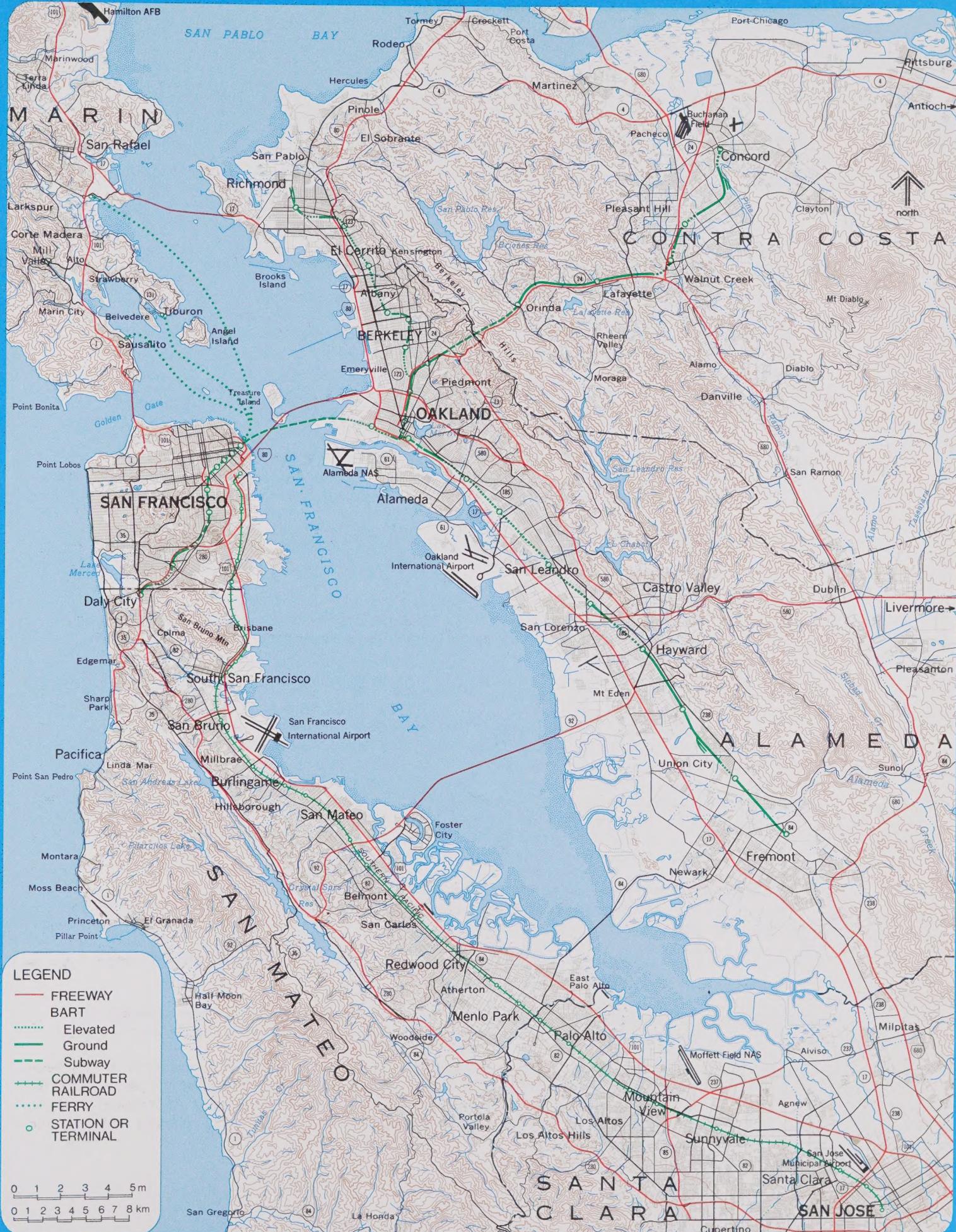
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A JOINT VENTURE

UNDER CONTRACT WITH THE METROPOLITAN TRANSPORTATION COMMISSION
FOR THE U.S. DEPARTMENT OF TRANSPORTATION
AND THE U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
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16. Abstract Options for monitoring the impacts of the Bay Area Rapid Transit (BART) system on land use and urban development are examined and evaluated in terms of the importance for policy making, the probability of impact and the measurement feasibility. Analysis techniques are discussed, and monitoring issues in each station area summarized. A recommended long-term monitoring program is presented, including a cost estimate for the first five years.			
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SAN FRANCISCO BAY REGION
CENTRAL AREA

BART: The Bay Area Rapid Transit System

Length: The 71-mile system includes 20 miles of subway, 24 miles on elevated structures and 27 miles at ground level. The subway sections are in San Francisco, Berkeley, downtown Oakland, the Berkeley Hills Tunnel and the Transbay Tube.

Stations: The 34 stations include 13 elevated, 14 subway and 7 at ground level. They are spaced at an average distance of 2.1 miles: stations in the downtowns are less than one-half mile apart, while those in suburban areas are two to four miles apart. Parking lots at 23 stations have a total of 20,200 spaces. There is a fee (25 cents) at only one of the parking lots. BART and local agencies provide bus service to all stations.

Trains: Trains are from 3 to 10 cars long. Each car is 70 feet long and has 72 seats. Top speed in normal operations is 70 mph with an average speed of 36 mph including station stops. All trains stop at all stations on the route.

Automation: Trains are automatically controlled by the central computer at BART headquarters. A train operator on board each train can override automatic controls in an emergency.

Magnetically encoded tickets with values up to \$20 are issued by vending machines. Automated fare gates at each station compute the appropriate fare and deduct it from the ticket value. At least one agent is present at each station to assist patrons.

Fares: Fares range from 25 cents to \$1.45, depending upon trip length. Discount fares are available to the physically handicapped, children 12 and under, and persons 65 and over.

Service: BART serves the counties of Alameda, Contra Costa and San Francisco, which have a combined population of 2.4 million. The system was opened in five stages, from September 1972 to September 1974. The last section to open was the Transbay Tube linking Oakland and the East Bay with San Francisco and the West Bay.

Routes are identified by the terminal stations: Daly City in the West Bay, Richmond, Concord and Fremont in the East Bay. Trains operate from 6:00 a.m. to midnight on weekdays, every 12 minutes during the daytime on three routes: Concord-Daly City, Fremont-Daly City, Richmond-Fremont. This results in 6-minute train frequencies in San Francisco, downtown Oakland and the Fremont line where routes converge. In the evening, trains are dispatched every 20 minutes on only the Richmond-Fremont and Concord-Daly City routes. Service is provided on Saturdays from 9 a.m. to midnight at 15-minutes intervals. Future service will include a Richmond-Daly City route and Sunday service. Trains will operate every six minutes on all routes during the peak periods of travel.

Patronage: Approximately 142,000 one-way trips are made each day. Approximately 200,000 daily one-way trips are anticipated under full service conditions.

Cost: BART construction and equipment cost \$1.6 billion, financed primarily from local funds: \$942 million from bonds being repaid by the property and sales taxes in three counties, \$176 million from toll revenues of transbay bridges, \$315 million from federal grants and \$186 million from interest earnings and other sources.

PREFACE

The BART Impact Program (BIP) is a comprehensive policy-oriented effort to identify, describe, measure, and present findings as accurately as possible about the multi-faceted impacts of a major public transportation investment — the BART system. The major objective of the Land Use and Urban Development Project is to determine how and to what extent BART has influenced the spatial arrangements of people and activities within the San Francisco Bay Area. To accomplish this task, the project will focus on the way BART has influenced (1) location decision processes; (2) actual movement behavior that results from those decisions and other market forces; and (3) the form, character, and functioning of aggregate spatial groupings that represent the net outcome of those decisions and movement patterns. Changes attributable to BART will be measured against pre-BART and no-BART alternatives. In all of these studies, BART's effects on individual socio-economic groups, particularly minorities and the disadvantaged, will receive careful attention.

The Land Use and Urban Development Project is one of six major projects comprising the BART Impact Program. The others are:

- Economics and Finance Project (E&F)
- Environmental Project (Env)
- Institutions and Lifestyles Project (ILS)
- Public Policy Project (PP)
- Transportation System and Travel Behavior Project (TSTB)

Each of these projects is designed to investigate specific aspects of BART's impacts, to explain why the impacts occur, and to identify who is affected by the impacts and the distributional effects. The projects then will demonstrate how the information derived can be used by decision makers to enhance the benefits and to reduce the dis-benefits of BART, and to increase understanding of the potential impacts of rail transit investments in the Bay Area and other American metropolitan areas.

This working paper presents the options for long-term monitoring of BART's land use, and outlines a recommended monitoring program. The paper is presented for review by BART Impact Program staff, federal sponsors, and other interested planners and researchers.

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SUMMARY

In some respects the Land Use and Urban Development (LU&UD) Project of the BART Impact Program (BIP) was premature because many of the effects of BART, the first rail rapid transit system to be completed in the United States in the past 50 years, only will be apparent after years of full, seven-day service. However, studies of housing and office construction, retail sales, household and workers' location decisions, employers' location decisions, and property prices and rents have indicated some BART impact, but the full nature and extent of many of these influences remains to be determined. The principal objective of the long-term monitoring program described in this paper is to provide accurate measures of changes in land use and urban development attributable to BART that will be useful for policy-oriented research and decision making. The monitoring program, if implemented, would provide a framework for testing policy options designed to maximize transit-related benefits and minimize adverse effects, and would contribute to our understanding of the impact process.

Future analysis of BART impacts studied during a long-term monitoring program should build on the findings of the BART Impact Program, and not simply replicate the investigations of the BIP. The first investigations of BART impacts were necessarily broad, because no one knew with certainty where the impacts were or how important they would be. While some of these broad research efforts discovered significant BART impacts, others did not, possibly because the techniques and available data could not detect BART's more subtle effects. Based on what was learned during the BIP, therefore, any further BART impact research should focus more narrowly on issues uncovered or refined during the research just completed.

For example, the study of employers' location decisions found that BART was not greatly influencing firms to leave one city for another. However, BART is enabling some firms to remain in a central city location that, except for BART, they might leave. BART's effects, then, might be indicated more by the firms that do not leave a central city area than by the firms that are attracted to a BART-served area. This subtle BART effect emerging from the BART Impact Program warrants further analysis in a long-term monitoring program.

Another example of an issue discovered by the project is BART's effect on shopping patterns. While many hypotheses of BART's effects were not supported by survey data, a significant relationship was found between new shoppers in three commercial areas and greater-than-average BART use. People who recently have begun shopping in downtown San Francisco, downtown Oakland, or Walnut Creek showed a significantly higher propensity to be BART riders than did long-term shoppers. However, the sample of new shoppers was too small to determine whether people have been attracted to the new areas because of BART, or whether these particular shoppers ride BART more often than average because they are new shoppers and are more willing to experiment with new forms of transportation. Long-term monitoring and further research could address this issue.

Finally, surveys conducted during the project suggest that the public may be perceiving BART benefits and disbenefits in complex terms other than, or including among others, travel time savings and noise. Future research and monitoring should focus on defining the dimensions of perceived BART benefits and nuisances, and then proceed to construct and monitor location and development decisions and land use changes which reflect these perceptions.

BART by itself does not have much, if any, impact on land use. When certain other factors are present, the benefits of BART are either enhanced or suppressed — likewise for nuisances. Such factors include permitted land use (zoning), other means of access, the importance of central location, parking lot overflows, neighborhood quality, and community perception of BART and other modes of travel. A long-term monitoring program, therefore, should include research on the factors which will enhance BART benefits or mitigate nuisances. Such a program can provide valuable information for regional and local planning programs, and complement existing monitoring and reporting programs which focus on transit system performance without considering indirect or cumulative effects.

In formulating the monitoring program, numerous options were considered, ranging from survey research and regression analysis to aerial photography and key informant interviewing. Each potential BART impact was evaluated in terms of its relevance for policy making, the probability of impact, and measurement feasibility. Priorities by station area also were established based mainly on development opportunities, but also on the findings of the individual work elements of the LU&UD Project.

The recommended long-term monitoring program addresses only those facets of the urbanization process BART is likely to affect. It includes monitoring travel patterns, station area land use changes, office and housing construction, location decisions, retail sales and shopping patterns, property prices and rents, and development patterns. For the first five years this program is estimated to cost \$400,000–470,000, depending on the level of detail required. If only high priority impacts are to be monitored and only the BART Passenger Profile Survey updated every two years, long-term monitoring costs could be reduced to about \$250,000. Both these estimates include an allowance for inflation (assumed to be 6 percent per year).

1. INTRODUCTION

Many of BART's impacts on land use and urban development may be quantifiable only after years of full, seven-day service. The Land Use and Urban Development (LU&UD) Project has examined the possible effects that might have occurred, first following voter approval of the BART bond issue in 1962, and then following the opening of interim service in 1972 and transbay service in 1974. The findings to date suggest that BART is influencing people's decisions on where to live and work and is affecting housing and office construction and other development decisions, but not to the extent anticipated by early BART planners.¹ Whether these impacts mark the beginning of a trend, indicating a major shift in development patterns, could not be determined with any confidence because of data limitations and the Bay Area's short experience with BART in operation -- a period fraught with service problems, train breakdowns, and adverse publicity.

The purpose of this working paper is to suggest options open to the Metropolitan Transportation Commission (MTC) and other public agencies to monitor BART's effects on land use and urban development with the objective of providing better information for decision making in the Bay Area. The proposed monitoring program presented in this paper is designed to address such questions as:

- What changes are occurring in station area land use, property values and rents, and building occupancy, and to what extent are these at all attributable to BART? What are the implications of such changes in terms of energy consumption and air quality impacts? Are some socioeconomic groups affected more than others?
- Are BART's land use impacts likely to increase as patronage increases or are there other intervening factors which affect BART's impacts on land use and urban development?
- What effects does improving train service, feeder bus service, or parking lot capacity have on land use impacts?
- Will supportive land use policies succeed in creating transit-oriented development? Will such development actually increase BART ridership?
- How might other changes in the transportation system or the process of travel affect BART's attractiveness and thus its ability to influence urban development decisions?

Another purpose of a monitoring program could be to illustrate how land use impacts of a rail rapid transit system built elsewhere might be analyzed and documented over time. Although this was not a specific objective of this work element, it is hoped that the options presented here might prove useful to those planning similar rail rapid transit investments.

1. Parsons, Brinckerhoff, Tudor, Bechtel, Composite Report - Bay Area Rapid Transit, San Francisco, California, May 1962.

The organization of this paper is straightforward. Chapter 2 presents options for long-term monitoring and addresses the issue of priorities and tradeoffs. Chapter 3 outlines a monitoring program, including the range of costs likely to be associated with each component of the program.

2. OPTIONS FOR LONG-TERM MONITORING

OBJECTIVES

To provide a framework for selecting long-term monitoring options, five objectives were identified. Together these represent the rationale for undertaking a program to monitor BART's impacts on land use and urban development. Other objectives could be added to the list, but these represent a reasonable starting point.

1. Provide information needed for decision making.
2. Provide a framework for monitoring the effects of policy options.
3. Provide a basis for long-range planning.
4. Provide a basis for further research.
5. Provide readily transferable information useful to the federal Urban Mass Transportation Administration (UMTA) and others charged with rail rapid transit planning.

The objectives can be met in a variety of ways, depending on whose needs are to be served and what the specific information requirements are. In the next section the issues raised by each of these objectives are addressed. These are presented to provide a perspective on the specific techniques — that is, the options for monitoring — that form the heart of the recommended program. Only after there is agreement among sponsoring agencies on the purposes to be served, can the specific form of the monitoring program be established.

OBJECTIVE 1: Provide information needed for decision making.

Better information on BART's long-term impacts on land use and urban development could improve the decision making process on local land use policy and also benefit those responsible for regional transportation planning. In BART-served communities, land use plans and capital improvement programs might be revised to reflect actual and anticipated build-out rates of BART-oriented projects. Station area development plans and zoning policy, including floor area bonuses and parking requirements, could be based on a better understanding of BART's effects on the demand for commercial and residential space.

If monitoring finds a lack of new office development, for example, near BART where such development is highly desirable, public officials could (1) check employers' location decisions for ways to enhance BART's influence, (2) adopt more radical incentive/restrictive zoning policies to encourage new development to locate near BART stations, or (3) undertake public projects aimed at revitalizing the area, making it economically more attractive for investment.

To cite another example, if monitoring sales tax data reveals that some BART areas are growing in popularity at the expense of other areas (BART-served or otherwise), local governments in the 'declining' areas may wish to take some sort of action to encourage patronage, such as supporting physical improvements (malls, landscaping, street beautification) or installing new, competitive transit links to the shopping district (free or low-cost busses, shuttle service from BART or from major AC Transit stops).

The BART District also might benefit from knowledge gained through a long-term monitoring program, particularly in making decisions on service levels, parking lot expansion, and feeder bus service. Plans for extensions to outlying areas could be revised to reflect the knowledge gained through the BART Impact Program and priorities established based on the expectations of future impact. Because the case for extensions rests in part on the urban form-giving ability of the BART system, the monitoring program should be an essential component of BART's planning so that extension decisions are based on the most current information.

The Metropolitan Transportation Commission (MTC) — the agency responsible for regional transportation planning in the Bay Area — could use the insights gained about BART's development impacts, particularly its long-term effects on specific corridors, in its Transportation System Management (TSM) and Transportation Improvement Programming (TIP). Ultimately, the decision on whether or not to fund a BART extension rests with MTC, so it, too, should want accurate, up-to-date information about BART's land use effects. Additional transit service is called for in the region's Air Quality Maintenance Plan as a means of reducing automobile travel and, consequently, vehicular emissions. Whether BART or bus service will have greater benefits from an air quality standpoint will depend in part on the long-term land use effects of each alternative. To the extent that BART influences workplace, residence and shopping location decisions and possibly auto ownership and corridor growth patterns more than a bus alternative would, it will reduce emissions of air pollutants more than bus alternatives offering comparable levels of service. Continued monitoring of BART's land use impacts will provide the information that MTC and others charged with air quality maintenance planning will need to decide how to improve and expand existing transit service to meet air quality standards.

Finally, federal agencies, principally the Department of Housing and Urban Development (HUD) and the Department of Transportation (DOT), could use the BART experience as a yardstick in evaluating impacts predicted for similar rail rapid transit projects.

To meet this objective mainly will require data collection; analysis and interpretation of BART's impacts would not necessarily be a major component of the monitoring program. Instead, agencies would draw on the information provided, as required for their own decision making needs, and base whatever analyses are desired on the methods already developed in the LU&UD Project.

OBJECTIVE 2. **Provide a framework for monitoring the effects of policy options.**

By careful design of sampling methods, choice of study areas, and selection of analysis techniques, the effects of specific policy options intended to maximize BART's benefits and minimize adverse effects might be gauged. Demonstration programs, such as implementation of a value capture policy, a shoppers' shuttle service, or station area zoning provisions, could be evaluated much more systematically and efficiently with information provided by a long-term monitoring program. To mention another example, the effects of a downtown parking tax on location decisions and the demand for retail and commercial space also might be understood more fully with information provided by a long-term monitoring program.

OBJECTIVE 3. **Provide a basis for long-range planning.**

Land use and transportation planning, on both a local and regional scale, could benefit from a long-term monitoring program. Because measures of BART's ability to affect land use and urban development would be based on empirical research, not planners' expectations, transit-oriented land use policies and programs would be technically defensible.

MTC's 1978-83 Overall Work Program calls for continued study of the transportation needs of the elderly and handicapped, and of minorities. Monitoring the distributional effects of BART's land use impacts — who gains and who loses — should provide valuable information for these planning studies. Are minorities and the transportation disadvantaged moving into BART-served neighborhoods or accepting jobs accessible by BART? What effect, if any, are BART-induced increases in residential property prices and rents having on housing opportunities for these groups, and how can any adverse effects be minimized or eliminated?

As with Objective 1, a program geared towards this objective mainly will require data collection; analysis and interpretation would be part of the planning process.

OBJECTIVE 4. **Provide a basis for further research.**

Although many of the hypotheses about BART's effects on land use and urban development proposed in the Study Design were satisfactorily tested with data collected for the LU&UD Project, others raised questions warranting further research.² In some cases the findings were inconclusive, while in others, a limited theoretical understanding of the urbanization process constrained the analysis.

2. John Blayney Associates/David M. Dornbusch & Co., Inc., Study Design and Project Implementation Plan (Berkeley: BART Impact Program Planning Document, March 1977).

For example, analysis of households' location decisions, conducted in Work Element 3, suggested that BART was important to some people moving to suburban Walnut Creek because it enabled them to keep their transportation options open. Although the survey respondents were not commuting by BART at the time, their answers suggested that they might patronize the system at some future date because of congestion or rising gasoline and parking costs. Further research is needed to support this interpretation of the survey data and to determine the relative importance of transportation options in moving and location decisions.

This approach to long-term monitoring will provide a mechanism for validating some of our interpretations and suggestions of future impact. This in turn could yield important empirical information for the field of predictive social research and could improve land use and transportation planning significantly by helping to establish, or challenge, indicators frequently used in impact assessment.

OBJECTIVE 5. **Provide readily transferable information useful to UMTA and others charged with rail rapid transit planning.**

This objective specifically addresses the needs of the federal sponsors of the BART Impact Program and also represents a dimension implicit in each of the other objectives. However, the reporting systems designed to meet this objective may be different from those oriented mainly toward Bay Area decision making, and the resources required may be greater as a consequence. More analysis and interpretation would be needed to place the findings in perspective than if the monitoring program simply were one component of a regional transportation planning process.

Before further resources are committed to achieve a high degree of "transferability", a systematic evaluation of the use of the BIP work to date might be warranted. A survey of rail transit planning efforts elsewhere could be designed to determine the relative importance of various types of information, the degree of detail and specificity desired, and an acceptable confidence level. This survey would show how important the criterion of transferability should be in a long-term monitoring program.³

These objectives are offered to focus the discussion on the purposes to be served by a long-term monitoring program. They are not to be viewed as sacrosanct, nor is any priority suggested by the order in which they were presented.

3. A somewhat related survey was conducted in the National Cooperative Highway Program and is reported in the Transportation Research Board Report 179, Evaluating Options in Statewide Transportation Planning/Programming: Issues, Techniques, and Their Relationships (Washington: 1977).

SELECTING IMPACTS TO MONITOR

In the wake of rising concern over public expenditures, a BART impact monitoring program can be justified only if it is cost-effective and policy-oriented; all facets of urban development that BART conceivably could affect need not be the subject of continued study, particularly if the BIP's findings to date suggest minimal impact. Three criteria might be used to determine whether a given phenomenon should be investigated:

1. The impact category is of greatest interest to policy makers, MTC, or officials constituting the sponsor/audience of the investigation.
2. The probability that some impact will be observed is high; that is, some degree of impact has been observed already, or current information portends an impact.
3. Measurement feasibility is good. Information is obtainable, data collection techniques are reliable and inexpensive, and the necessary data base already exists.

Obviously, there can be trade-offs among criteria. For example, if some factor is extremely important to decision makers, they may wish to monitor it even if no evidence for an impact exists; perhaps the knowledge of a continued non-impact will be judged to be important enough to justify continued research. The possibility of such trade-offs should be borne in mind when the suggested options for long-term monitoring are presented in the following section.

Table 1 summarizes the project team's evaluation of priorities for monitoring BART's land use impacts in terms of these three criteria. Some notes of explanation about the rankings are in order. First, BART's ability to affect land use depends on its ability to offer a competitive transportation service. Thus, if no further changes in BART's accessibility and mobility impacts are noted, monitoring changes in location decisions, development decisions, or market effects need not be pursued. While this is unlikely in view of the planned improvement in service levels, it should be considered a condition of future monitoring.

Second, land use policy changes should be a major component of the monitoring program, for they often foreshadow and are most important influences on development and location decisions. (Whether other public policy questions need to be monitored was not addressed because this subject falls within the scope of the Public Policy Project.)

Third, in interpreting the probability of impact assigned by the project team, the reader should understand that this refers to an expectation based on empirical analysis of three to four years operating experience, and not an assumption about an unknown effect. In establishing these probabilities, we are looking ahead 10 to 15 years, not just two to three years. Expressed differently, these

probabilities are based on revealed preferences, not just suppositions about BART's impact, for we have measured what has actually happened, not what people expected to happen or perceived happening.

Finally, this matrix provides only one perspective on the monitoring issue. It shows what categories may be of greatest interest, but not where the monitoring should take place. This latter question is addressed in a following section. But first, a review of the specific data collection techniques which might be used for long-term monitoring is in order to place the geographic priorities in perspective.

DATA COLLECTION TECHNIQUES

In the LU&UD Project, a number of data collection techniques were used to obtain information on activities BART might have affected: station area land use, construction and rehabilitation, shopping and retail sales activity, property values and rents, and local land use policy. Sometimes data were collected to analyze a specific BART impact, while in other cases, notably the surveys, a range of information was obtained about many different types of impacts. The data collection effort was oriented toward the specific hypothesis tests. Because the objectives of a long-term monitoring program may differ somewhat from those established for the LU&UD Project, data collection techniques for long-term monitoring need not be the same. Further, a monitoring program can build on the information assembled by the LU&UD Project, updating the data base with well-structured sampling procedures and screening aerial photos and construction reports to find areas of potential impact. Specific data sources used in the LU&UD Project and their strengths and limitations for monitoring purposes are described in the following section.

System User Characteristics

BART's monthly patronage reports and the 1976 MTC Passenger Profile Survey were the main sources of information on ridership and the socio-economic characteristics of BART patrons. With BART's on-line reporting system, ridership data can be obtained at various levels of aggregation, depending on the researcher's needs. For any given station or line segment, patronage volumes are available for any time period, from hourly totals to daily peak or off-peak, or monthly averages.

For long-term monitoring the BART Passenger Profile Survey should be conducted at least every two years. Comparison with prior surveys will show whether the ridership profile is changing. If patronage is higher among workers or households who recently have moved into an area, or business or shopping trips on BART increase dramatically at one or more stations, then further study of BART's effects on location and development decisions, retail sales, and shopping patterns in these station areas might be warranted. The cost of the survey is rather reasonable, particularly if cooperative arrangements can be made with BART.

TABLE 1. EVALUATION OF BART'S LAND USE IMPACTS FOR LONG-TERM MONITORING

Impact Categories	Importance in Policy Making (0=Unimportant, 5=Very Important)	National	Regional	Local	Probability of Impact (0=Unlikely, 1=Certain)	Measurement Feasibility (0=Very Poor, 5=Excellent)	Priority for Monitoring (High-Low)
Accessibility and Mobility							
— System-wide	5	5	3		.8	4	High
— Station areas	3	3-4	5		.6	3	Moderate
Local Land Use Policy	4	4	4		.4-.6	3-4	High
Location Decisions							
— Workers	2	3	4		.3	2	Low
— Households	2	4	5		.5	3	Moderate
— Employers	2	4	5		.2-.3	3-4	Moderate
Development Decisions							
— Office construction	3	5	5		.3	4	Moderate
— Housing construction	3	4	5		.4	3-4	Moderate/High
— Institutional construction	4	5	5		.7	4	High
— Redevelopment	4	5	5		.3-.6	4	Moderate/High
— Rehabilitation	1	1-2	2		.1	2	Low
Market Effects							
— Speculation	0	1-2	3		.3	1	Low
— Retail Sales	3	5	5		.3	3-4	Moderate
— Shopping patterns	2	3	3		.4	2	Moderate
— Property values and rents	4	5	5		.7	4-5	High
Regional Effects							
— Development patterns	4	3	2		.3	1-2	Moderate/Low
— Minorities	4	3-4	3		.3	2-3	Moderate
— Socio-economic groups	4	4	4		.8	4-5	High

Source: John Blayney Associates/David M. Dornbusch & Co., Inc.

For a survey of 8,000-10,000 riders, BART budgets about \$20,000, or \$2-3 per completed interview. Because a long-term monitoring program might want a greater degree of control over interviewing to be able to quantify any potential response bias, the survey costs may be somewhat greater than those estimated by BART.

Accessibility and Mobility

The accessibility and mobility analyses conducted in the LU&UD Project were intended to provide a starting point for the specific studies of how BART might have affected land use and urban development, the assumption being that BART's greatest land use impacts would be in the areas where BART offered the greatest gains in accessibility and mobility. Using a regional transportation modelling system maintained by MTC, comparisons between BART and a No-BART alternative were conducted. For a variety of trips and trip combinations, differences in travel time and cost were calculated, and the results mapped on a zonal basis. In retrospect, this approach to analyzing accessibility and mobility impacts proved limiting, for it neglected other features of travel behavior that often dictate a choice of mode: convenience, ease of transfer, safety, and other, sometimes unquantifiable aspects of a trip. A better understanding of how BART affects overall mobility, either on a corridor scale or system-wide, is needed in order to relate these impacts to the indirect effects on land use and urban development. The transportation system as a whole needs to be examined, and travel behavior should be carefully monitored to see what changes BART induces.

Station Area Land Use

Current land use was obtained from 1977 aerial photographs and street level photographs of the station areas and land use maps maintained by local planning departments. Changes in station area land use were identified by comparing the 1977 aerial photographs with similar photographs taken in 1975 and 1965. Since aerial photographs are rather inexpensive to obtain (\$80 per station area or \$2,700 for a complete set covering the whole system), they should be an integral part of a long-term monitoring program. Street level photographs, by contrast, are rather costly (averaging \$320 per station area) and cannot be manipulated easily. Consequently, they would not be essential for long-term monitoring purposes.

For the study of speculation, use permits and homeowners' exemption records also were assembled, and differences analyzed in relation to proximity to a BART station. This, along with other information including key informant interviews, showed that while some speculation may have occurred at certain of the station areas, the activity has by now disappeared along with declining expectations vis-a-vis BART impacts. Richmond is an exception, where some speculation may still be going on. Therefore, further study probably is not warranted, given the significant time and expense involved in data collection unless anticipation of greater BART impacts start to pick up again among real estate investors. This effect can be determined most efficiently with periodic key informant interviews; extensive data collection should not be necessary.

New Construction and Rehabilitation

The principal source of information on station area construction and rehabilitation activity is the building permit, which shows the address of the project, the construction value, the owner/applicant, the number of units proposed or amount of commercial space, and other pertinent data. Monthly construction reports filed by all cities with the Bureau of the Census show total permit activity authorized and list pertinent information on all major projects (\$100,000 or more in value). Some jurisdictions maintain records of construction activity for individual planning areas, but most do not. Consequently, gathering information on individual projects within station areas frequently can be rather time-consuming.

For long-term monitoring, building permits should be obtained for all major construction in BART station areas. Permits for rehabilitation — alterations and additions — need not be collected. Evidence so far shows that BART has not had any measurable effect on this activity. To obtain current records on building activity in the five major cities studied (San Francisco, Oakland, Richmond, Fremont, and Walnut Creek) probably will require about 10-15 person days per year. If construction in all station areas is to be monitored, then 40-50 days might be needed.

Travel Behavior, Shopping, and Location Decisions

Four major surveys were conducted to obtain information on travel behavior, shopping patterns, and workplace and residential location decisions. Three of these were undertaken in the LU&UD Project, while the fourth, the Workplace Survey, was designed mainly to meet the needs of the Transportation Systems and Travel Behavior (TSTB) Project. The pertinent characteristics of each survey are as follows:

- MTC Workplace Survey: This was conducted in 1977 among workers employed within a set of 88 traffic analysis zones (two to four census tracts in size) readily accessible by BART. This survey had 8,391 responses, an approximately one in 60 sampling of the workers in the area surveyed. It focused on mode choice, travel time, work and residence location, and demographic characteristics. With a \$60,000 budget for the survey itself, the average cost was \$7 per completed interview.
- Households' Location Survey: A study of 315 households and their reasons for moves into Walnut Creek, into the Mission District, and out of East Oakland (see the Study of Households' Location Decisions).⁴ With a \$25,000 budget for the survey alone, this represented \$80 per completed interview — much of the added cost due to time required to identify and trace movers.

4. John Blayney Associates/David M. Dornbusch & Co., Inc., Study of Households' Location Decisions (Berkeley: BART Impact Program Land Use and Urban Development Project Working Paper, February 1978).

- Downtown Workers Survey: A study of 314 workers who had switched or started work in downtown San Francisco or Oakland during the past three years (see the Study of Workers' Location Decisions).⁵ Because this survey involved a two-stage interviewing process -- first an intercept interview, and then a follow-up telephone interview -- the average cost per completed interview (\$100) was the highest of all surveys.
- Retail Shoppers Survey: A study of 499 shoppers in six commercial areas, probing their current shopping trips, historic and current shopping patterns, and demographic characteristics (see Study of Retail Sales and Services). Respondents were screened to eliminate people who had not lived in the BART service area for at least three years and to obtain a 50-50 split between BART riders and nonriders.⁶ For this survey the average cost per completed interview was \$27.

The survey research costs noted above refer only to survey design, data collection, coding, and computer processing to obtain a clean machine-readable data tape; no analysis costs are included. In fact, for monitoring purposes, the survey costs may be somewhat below those cited above if no major changes in sampling design or questionnaire format are required.

To permit cross-survey comparisons, MTC established a data policy for the BART Impact Program, prescribing a common format for all survey research. This was vigorously adhered to in questionnaire design, coding, and data processing for each of the surveys, and should facilitate future survey research considerably.

Key Informant Interviewing

For the LU&UD Project nearly 200 interviews were conducted with people knowledgeable about BART and its effects on land use and urban development. The interviews were intended to solicit information not readily available from published reports and news clippings on the decision making process, the motivation behind key factors, and the cause of changes in land use, property prices, tenure, ownership, shopping patterns, and location decisions. In addition, key informant interview notes obtained from other BIP projects, notably the Economics and Finance and Environment projects, were critically reviewed, and in some instances follow-up interviews were conducted to clarify ambiguous points or to cover related topics of interest. Table 2 presents an occupational breakdown of those included in the key informant interviewing program.

Because key informants often can provide valuable insights into the impact process, they should be used extensively in a long-term monitoring program.

5. John Blayney Associates/David M. Dornbusch & Co., Inc., Study of Workers' Location Decisions (November 1977).
6. John Blayney Associates/David M. Dornbusch & Co., Inc., Study of Retail Sales and Services (April 1978).

TABLE 2. OCCUPATION/AFFILIATION OF THOSE INTERVIEWED
ABOUT BART'S LAND USE IMPACTS

<u>Public Sector Informants</u>	<u>Number</u>	<u>Percent of Total</u>
Elected Officials	3	1.5
Planning Directors	10	4.9
Other Public Agency Staff	29	14.1
 <u>Private Sector Informants</u>		
Appraisers	6	2.9
Apartment Managers	23	11.2
Bankers	13	6.3
Businessmen (excluding retailers)	11	5.3
Community Organizers	12	5.8
Design Professionals (architects and engineers)	9	4.4
Developers	33	16.0
Leasing Agents	10	4.9
Realtors, Property Managers	23	11.2
Retailers	21	10.2
Others	<u>3</u>	<u>1.5</u>
Total	206	100.0

Source: John Blayney Associates, David M. Dornbusch & Co., Inc.,
Human Resources Corporation

As a first step in structuring a follow-up interviewing program, all interview notes should be reviewed and correlated to paint a picture of the key informant resources. MTC's key informant file also should be checked before any interviews are scheduled.

Market Effects

For the study of BART's effects on property values and rents and retail sales, time series data were collected. In the property values study, these included commercial and residential transaction prices and rents for buildings located in station areas which were obtained from cooperating county assessors' offices, local boards of realtors, and leasing agents. Although these sources provided data at no cost, substantial effort is required to select data sets suitable for analysis. For the retail sales study, sales tax data were obtained from the State Board of Equalization for a sample of stores in 17 shopping areas. The costs of these data was \$1,200 for each annual listing, and the Board of Equalization requires advance notice of approximately three months. Because of the importance of these impacts for policy making, continued monitoring of sales and rent data undoubtedly is warranted.

Impacts on Minorities

In all the surveys, questions on the ethnicity of respondents were included to permit analysis of distributional effects: Were minorities affected any differently than other socioeconomic groups? Key informant interviews also covered BART's impacts on minorities to complement the survey research. However, small sample sizes often limited the conclusions that could be drawn. Because racial/ethnic minorities constitute a large proportion of the population of the BART district, continued monitoring of BART's effects on minorities is warranted. This can be done either with special studies focusing on minorities or by oversampling for minorities in the individual surveys included in the monitoring program. Without samples of 100 or more minority respondents, statistically reliable conclusions cannot be drawn. Since minority concerns also were examined by MTC's Minority Transportation Needs Assessment Project (MTNAP) with guidance provided by the Minority Citizens Advisory Committee (MAC), any work on long-term monitoring of BART's effects should be coordinated with implementation of the MTNAP-MAC recommendations.⁷

Local Land Use Policies

To complete the information base, all relevant planning and zoning studies, capital improvement programs, and redevelopment project reports were obtained.

7. Jefferson Associates, Minority Transportation Needs Assessment Project Final Report (Berkeley: Metropolitan Transportation Commission, June 1978), pp. 213-218.

Often these contributed a great deal to our understanding of why development occurred in one station area but not in another, and the relative importance of local land use policies in interpreting urbanization patterns. Most of the information that could be mapped was organized for Work Element 15 in an atlas format to facilitate analysis and interpretation. The Station Area Land Use Atlas also was designed to be easily updated as further information became available, and thus would be an integral part of a long-term monitoring program. It will be available for use at MTC at the completion of the project.

MONITORING ISSUES AND PRIORITIES BY STATION AREA

To some, the question may not be how useful is it to monitor a specific BART-related activity, but rather, what is going to happen in the BART-impacted area? Where are the "hot spots" — the areas with the greatest likelihood of a transit-induced change? To respond to these questions, the monitoring priorities in each station area were evaluated. The following sections highlight monitoring issues and describe some of the opportunities for land use changes which might be affected by BART.

Richmond Corridor

Richmond Station — Development within the Richmond Redevelopment Area should be closely monitored to determine whether any additional projects will be influenced by proximity to BART. Employers' location decisions and office construction in the station area also should be monitored. Analysis of BART use for reverse commuting among Social Security and Kaiser Medical Center employees may suggest an effect on workers' location decisions.

Outside the redevelopment area, little land is vacant. The largest developable site is a triangular parcel at the intersection of 18th Street and Bissell Avenue, southeast of the station. This land currently is zoned for multi-family residential use. Another vacant parcel lies just east of the station south of Nevin Avenue, zoned on the north side for high-density residential, and in the south for central business. Development on both sites should be monitored.

El Cerrito del Norte Station — Much of the land within 1,500 feet of this station lies within a redevelopment project area, so development here warrants careful monitoring to determine whether prospects are at all enhanced by BART.

El Cerrito Plaza Station — Here, too, the City's redevelopment project encompasses much of the land west of the station, including the shopping center. However, few vacant parcels are available for development, so significant land use change is unlikely.

BART's effects on shopping patterns and retail sales, property prices and rents warrant continued monitoring; this station area probably should be included in a follow-up shoppers survey.

North Berkeley Station — This station area is included within a redevelopment project bounded in the main by Sacramento Street, Cedar, and Berkeley Way, and West Street. In this station area, highest priority should be given to following-up on what happens to the "Hearst Strip" lands cleared to accommodate BART in cut-and-cover subway. Only about half the Hearst Strip in this station area lies within a redevelopment project, so development outside will not benefit from any public assistance potentially available with redevelopment. Property price and rent changes in this station area also warrant monitoring.

Berkeley Station — Around the Berkeley station, lands are fully developed for downtown and institutional use (University of California), so opportunities for change in land use are quite limited. However, this station area was included in the shoppers survey as well as the retail sales analysis, so continued monitoring of these impacts may be in order, particularly in view of the City's policies aimed at revitalizing the downtown. The study of office construction also found some impacts in the station area, and though the sample was small, these should be examined in light of future office construction trends to see what BART's long-term effects are. Of further note is the influence of the University of California and the Humphrey Go-BART shuttle service on station usage — these two factors alone may justify including this station in a monitoring program.

Ashby Station — During BART's construction, retail sales in the station area declined and have not reversed to pre-BART levels. Although this area was not included in the retail sales analysis conducted for Work Element 9, some long-term monitoring may be justified, especially if new stores locate on Ashby, Grove, and Adeline Streets or existing storefronts are renovated.

Oakland Corridor

Coliseum Station -- Because this station was not specifically studied, no recommendations for long-term monitoring are offered. Opportunities for change are limited; all lands to the west of San Leandro Street primarily are in industrial use, or are reserved for the Coliseum, while to the east of the station single family and duplex homes predominate. No large parcels of land are available for development within 1,500 feet of the station.

Fruitvale Station — Within the station area, most of the land is zoned for commercial or industrial use, but currently is in single family use. Because of

land assembly problems, station area development is likely to proceed rather slowly, and probably will not be affected much by BART, according to key informant interviews. However, some attention might be given to any major developments proposed for this area to determine the extent to which BART may have played a role. Given the weak market for commercial and industrial land in this area, and the high cost of site assembly and demolition, close monitoring of development probably should not be a high priority.

Lake Merritt Station — This station area is fully developed and, at least in the short run, opportunities for significant land use change are quite limited. Thus, it probably need not be included in a priority monitoring program. The exception possibly is the redevelopment project area southeast of the intersection of Fallon Street and 7th Avenue, two blocks from the station. This land currently is used for parking, but may be developed for some other use possibly related to BART or the Civic Center.

MacArthur Station — Because this station area was not specifically studied, no recommendations for long-term monitoring are offered. Further, this station location in the median of the Grove-Shafter freeway does not offer the most attractive opportunities for transit-oriented development in a built-out urban residential area.

19th Street Station — Of concern here is the extent to which the private market will develop much of the land in the vicinity of this station for more intensive use. Will the station area attract a share of privately sponsored office construction, and what role will BART play in future investment decisions in downtown Oakland? Will employers' location decisions be affected by BART?

Retail sales and shopping patterns, and property prices and rents also deserve monitoring, and this station area should be included in any follow-up shoppers survey.

12th Street Station -- Development in the City Center Project and the Chinatown Project, particularly the Hong Kong/U.S.A. Project and the shopping center, should be carefully monitored, and developers and major employers moving into the area interviewed to determine importance of proximity to BART in their decision making. Retail sales trends, property prices and rents, shopping patterns, and the overall character of the station areas also should be monitored, and this station area included in any follow-up shoppers survey.

Oakland West Station -- Because this area was not specifically studied, no long-term monitoring recommendations are offered.

Fremont Corridor

Fremont Station — Close monitoring of residential and commercial development in this station area should receive high priority, particularly the Great American Land Development Project (formerly called the Hub) — a planned 712-unit high density residential development oriented toward a BART market which is scheduled for construction in 1978-79. The status of State Route 238 also should be monitored. The success of the Fremont Fashion Plaza, adjacent to the station, should be evaluated periodically to see what effect, if any, BART will have had on sales and store patronage.

Union City Station — High priority should be given to monitoring development proposals on vacant parcels north and southwest of the station.

South Hayward Station — Because most of the immediate station area is developed for residential use, single family homes and trailer parks, opportunities for further development are limited to scattered sites less than five acres in size. One worth watching in particular is the corner lot at Tennyson Road and Mission Boulevard east of the station. Informants had indicated that, although this was zoned for high-density residential use, Safeway had expressed interest in developing it. Property price and rents also should be monitored since BART appears to have had some effect on these already.

Hayward Station — The immediate station area lies within a redevelopment project, so development near the station, particularly on the cleared parcels to the west, should be studied to determine the extent to which redevelopment facilitated land assembly and new construction. To the northeast, the City has proposed measures to revitalize the downtown retail areas and provide local transit service to the station. How successful implementation of this proposal is warrants monitoring as a further example of combining redevelopment activities with the opportunities for increasing transit-oriented land use and development.

Bay Fair Station — Implementation of the Special Area Plan for the Bay Fair station prepared by Alameda County and the City of San Leandro should be evaluated. Vacant lands designated for medium to high-density residential use currently are zoned for commercial use in conflict with state law calling for consistency between zoning and the general plan. Only time will tell whether planning will prevail over the interests of specific landowners. The success of the planned expansion of retail and commercial facilities on the old drive-in lot north of Bay Fair Drive also should be examined. Does proximity to BART make any difference? Around the Bay Fair station, the T-2 District designation, Rapid Transit, is used for vacant land north and south of the station along Hesperian Boulevard, including the drive-in theater site. Whether this zoning has influenced any specific development proposals also should be evaluated in a monitoring program.

Bay Fair provides an interesting contrast to El Cerrito Plaza where the shoppers survey indicated some BART effect on shopping patterns. Whether this will occur at Bay Fair may justify monitoring and including this area in a follow-up shoppers survey.

San Leandro Station -- The City has a redevelopment project extending into the station area between Juana Avenue and Joaquin Avenue. Consequently, some redevelopment might be expected within the vicinity of the station, at least to the east. To the west are industrial and warehouse uses. Almost no vacant land is available for development within 1,500 feet of the station, except for some parcels within the redevelopment area, and some scattered, recently cleared sites south of San Leandro Creek. These lands are designated for general commercial use. The redevelopment project includes Lincoln School which might be closed down. Finally, the City has designated some lands as a T-2 District, Rapid Transit, where development should be monitored.

Concord Corridor

Concord Station -- Most of the land north and west of the station, including the only large vacant parcels near the station, is within a redevelopment area. Development on the vacant sites should be monitored, as should the condition of single family residential property in the station vicinity to see how much rehabilitation occurs and whether any of it is BART-related. Otherwise, opportunities for change in this station area appear limited. Because of this, the Concord station probably should not be given high priority in a monitoring program.

Pleasant Hill Station — Much of the land surrounding the station is vacant or developed for low-intensity uses, and the ultimate use of these lands has been the subject of considerable controversy and much debate. Whether proposals for office and residential use are approved and the projects are successfully completed should be studied. Property price and rent changes potentially attributable to BART also should be monitored.

Walnut Creek Station — Except for the triangular parcel south of the station, few opportunities for development on vacant land exist in this station vicinity, unless new construction were to occur on sites currently used for parking. The residential neighborhood to the north, designated for an "elective use" by the City, might be redeveloped for more intensive use. The commercial areas east of the station are not fully developed, at least to intensities permitted by zoning. Whether the market justifies further investments in this station area should be carefully monitored, and the extent to which new commercial and residential development is influenced by proximity to BART should be documented. The

station area also should be included in an updated shoppers survey and analysis of retail sales. Use of the shuttle bus service also should be monitored. The property price and rent impacts due in part to the overflow parking problem should be re-examined periodically.

Lafayette Station — Because this station was not specifically studied, no recommendations for long-term monitoring are offered. Some opportunity for development exists on the vacant lands west of the station and north of Deer Hill Road. Since this is just north of the station, some monitoring may be justified.

Orinda Station — Because this station was not specifically studied, no recommendations for long-term monitoring are offered. Some commercial development could go in on the large vacant parcel just north of the interchange and south of Altarinda Road.

Rockridge Station — With the residential rezoning in 1974 in response to fears of BART-oriented high density development, opportunities for major changes in land use were significantly reduced, and no vacant land exists within 1,500 feet of the station. Consequently, monitoring of development or redevelopment in this station area probably is not warranted. However, BART's effects on residential property prices and rents may deserve further study.

Daly City Corridor

Daly City Station — This station area is virtually developed, and the opportunities for large-scale change are quite limited. Monitoring development in the redevelopment project area along Mission Street might be warranted, but given the nature of the station area (predominantly single family homes), proximity to a major freeway, and the high park-and-ride orientation of station users, the potential for transit-oriented development is quite limited. The effects of the overflow parking on adjacent neighborhoods might be worth monitoring if the expanded BART parking lot proves unable to accommodate the demand.

Balboa Park — Because this station was not specifically studied, no long-term monitoring recommendations are offered. Further, little vacant land is available for development.

Glen Park Station -- No long-term monitoring recommendations are offered, except possibly the continued monitoring of BART's effects on residential property prices and rents.

24th Street and Mission — In the past 15 years, no major development has occurred in the Mission, but this may change. Monitoring of development proposals is warranted. This area also should be included in the follow-up shoppers survey, but another survey of households moving into the Mission probably should receive low priority, unless station patronage increases markedly.

16th Street Station — The 16th Street study completed by the Mission Planning Council in cooperation with the City in 1977 called for a major effort to upgrade the station area. BART's role in facilitating implementation proposals should be evaluated, particularly to determine whether any development proposals geared toward BART are accepted or rejected specifically because of the BART orientation. Some vacant land is available for commercial development in the blocks adjacent to the station, but no specific development proposals have been submitted.

San Francisco Downtown Stations -- Around the Civic Center, Powell Street, Montgomery Street, and Embarcadero BART stations, major commercial, institutional, and office construction should be monitored. The impact of completion of the Yerba Buena Center also should be examined, and changes in patronage should be carefully evaluated.

These downtown station areas should be included in a follow-up shoppers survey, retail sales analysis, property price and rent analysis, and (a low priority item) workers' location survey. The impacts of changes in downtown parking charges and transbay bus service (cutbacks, as a result of Proposition 13, the Jarvis-Gann Initiative, for example) also warrant careful monitoring to gauge the relative effect these changes have on BART usage. Finally, the soon-to-be-completed Muni Metro system under Market Street should be evaluated in terms of its effect on BART usage and downtown land use, shopping patterns, retail sales, and property prices and rents.

3. RECOMMENDED MONITORING PROGRAM

The recommended monitoring program presented in this chapter builds on the assessment of monitoring options: what impacts should be studied, where they are most likely to occur, and how they should be measured. For each impact category, a monitoring method, study area locations, timing, and priorities are indicated. The monitoring program responds to all five objectives established at the beginning of this paper, thus meeting the information needs of MTC and the federal sponsors. Reporting procedures are described and a cost estimate is included to give the monitoring program an economic dimension.

MONITORING PROCEDURES

Accessibility and Mobility

Monitoring Method: Passenger Profile Survey or Workplace Survey

Locations: System-wide for Passenger Profile Survey (all stations)
high employment traffic zones served by BART for Workplace Survey

Timing: Passenger Profile Survey every two years; Workplace Survey every five years

Priority: High

Much of the BIP work to date has focused on accessibility comparisons and potential for change with BART as compared with a theoretical No-BART Alternative. For these studies accessibility was measured in terms of travel time, transfers, waiting time, comfort and so on. What will become increasingly important in the future will be the degree to which BART affects actual travel behavior, the movement of people, measured in terms of trips and trip purposes. To determine this, periodic surveys of BART riders and residents of the three BART counties should be undertaken. When these surveys are correlated with actual ridership trends — increases in patronage — they will show where the greatest gains in mobility have occurred and suggest where the land use impacts may occur.

Gains in accessibility also should be examined in terms of the effects of improved headways, travel times, and feeder service. Both system-wide and station area accessibility and mobility changes should be documented to provide basic information on BART's transportation service for use in other analyses. Further, these periodic surveys can be used as screening devices, pinpointing high patronage areas with the greatest potential for land use impacts.

For the outlying communities served by BART, one indicator that might be used for monitoring is patronage per 1,000 residents, considering peak hours,

off-peak, and weekend travel separately. Significant changes in this measure might suggest that detailed studies of land use changes are in order.

Station Area Land Use

Monitoring Method: Aerial photographs, key informant interviews

Locations: All 34 stations

Timing: Every two years

Priority: High

One of the most useful indicators of a change in station area land use is an aerial photograph. The June 1977 station area aerial photography should be updated at least every two years, and all land use changes indicated on a set of prints to be included in the Station Area Land Use Atlas -- a compendium of aerial photographs showing land use changes since 1965, as well as 1977 zoning. This will provide a clearly organized, chronological record of development around BART stations.

The aerial photographs should be viewed as a screening device, suggesting where potential land use impacts might have occurred. If no major changes are noted in any given station area, then further study of BART's effects on land use and urban development should be undertaken only if major increases in station patronage suggest an impact on shopping patterns, location decisions, or property prices and rents. In the absence of any marked increase in BART ridership and new station area development, continued monitoring may not be warranted.

Household Location Decisions

Monitoring Method: Household Survey

Locations: Walnut Creek (possibly Fremont, Daly City, and San Francisco's Mission District)

Timing: Once again in five to ten years

Priority: Moderate

Because we found that BART has had the greatest effect on residence location decisions of long-distance commuters, continued monitoring of this subject is justified in outlying communities, such as Walnut Creek and possibly Fremont and Daly City. For consistency, the Mission District might be included, but this should be low priority because BART has had little effect on the decisions of households moving into this residential area. No further surveys of those leaving inner city areas such as East Oakland are recommended because of the high cost and unreliability of the information obtained.

Follow-up surveys of moving households should focus on (1) whether BART continues to affect both riders and non-riders -- the hedging phenomenon, (2) the willingness to pay a premium for station area housing and improved service levels, and (3) differences between socio-economic groups. (For further discussion of this, see the Study of Households' Location Decisions.)

Repetition of the Household Survey in five or ten years will show whether a trend has been established. The sample size of 150 per area probably should be maintained to permit statistical analysis of the results. Focused surveys of residents moving into BART-oriented projects, such as the proposed Great American Land Corporation's development around the Fremont BART station, should be conducted shortly after the project is opened for occupancy to obtain accurate information about BART's role in the decision to move into the project. Findings of this type of survey then could be correlated with area-wide surveys of movers coming into the community to see if those selecting a BART project are markedly different from other new residents.

Questions on factors affecting household location decisions and the importance of BART in neighborhood choice also can be included in the Workplace Survey, so a separate household survey may not have to be repeated in the near-term. The advantage of the Household Survey is that it focuses just on movers, thus providing much more information on BART's influence than could be obtained from the Workplace Survey.

Another source of information on location decisions will be the 1980 Census. Early negotiation with the Bureau of Census might be in order to insure that questions on BART as a transit mode and reason for a move are included.

Workers' Location Decisions

Monitoring Method: Workers Survey

Locations: Downtown San Francisco and downtown Oakland

Timing: Once again in five to 10 years

Priority: Low

Although the location of a job itself typically is a secondary rather than a primary factor in job choice, the desirability of any given job location often is a function of BART accessibility. However, continued monitoring of this impact with a separate survey of workers who recently have changed jobs need not be a high-priority item. Questions about BART's importance in job choice could be included in the Workplace Survey or the BART Passenger Profile Survey.

If the Workers Survey is repeated, it should be conducted in downtown San Francisco and downtown Oakland to permit comparison with the survey conducted

for Work Element 4. The sample size of 150 completed interviews for each area provides sufficient information for statistical analysis and should not be reduced in a follow-up survey.

Employers' Location Decisions

Monitoring Method: Key informant interviews

Locations: Downtown San Francisco, downtown Oakland, Richmond (possibly El Cerrito, Fremont, Union City, Hayward, Pleasant Hill, Walnut Creek, 16th Street, Mission)

Timing: Once again in five years

Priority: Moderate

We found that BART in itself played a negligible role in most employers' location decisions. But, in a few instances, BART turned out to be an important factor, particularly where other influences were present. Therefore, it may be of interest to monitor employers' location decisions to determine (1) if BART continues to play a minor-to-negligible role relative to other influences, (2) if government agencies continue to be more influenced by BART than are private firms, and (3) if some firms are still encouraged to remain in the central cities because of BART.

Key informants should be selected from firms that recently have moved into or out of BART station areas. In order to identify these firms, new office construction and major tenant changes would have to be determined. Office construction should be monitored by biannual review of the station area aerial photos, but a more efficient way would probably be to interview local planners each year. They could identify employers' moves within the city as well as to and from the city. Tenancy changes would require interviews with those knowledgeable about the business community.

The timing of the monitoring could be linked to a predetermined indicator by setting some threshold number of location or tenancy changes in each area. When the threshold is surpassed, then further analyses could be conducted. Alternatively, the monitoring could be performed periodically on, for example, a five-year basis. The decision of whether to repeat the study after the first monitoring would depend upon the findings; if no impacts are found after five years, the program should be discontinued.

The sites chosen for study should include Oakland, San Francisco, and Richmond — the areas where impacts have been previously detected. Several other station areas have not yet, but in the future might be affected. Annual reports of new office construction would show whether employer movement is occurring in these other areas (since they are less likely than the central cities to have major tenancy changes — they would more likely have new construction). If

a major employer moves into any of these station areas during the five-year period, that area might be included in the analysis.

The number of key informant interviews would depend upon the number of movers. The three main locations would probably involve 15 to 20 interviews. Unless tenancy changes could be investigated in some other manner, two to four interviews would be needed for each site under study. The informants here would be employers, developers, planning officials, or others familiar with development in each area (realtors, investors, chambers of commerce).

Office Construction

Monitoring Method: Review building permit and aerial photos, key informant interviews

Locations: San Francisco, Oakland, Richmond, Berkeley, Walnut Creek (possibly also El Cerrito Plaza, Fremont, Hayward, Bay Fair, San Leandro, Concord, Pleasant Hill, and the Mission District)

Timing: Every five years with annual data collection

Priority: Moderate

We found that BART has not caused a redistribution of office space in the Bay Area. Thus, looking at building permits on a citywide scale (to compare one city with another) does not seem to be warranted; first, because of the absence of any observed impact so far and secondly, because of the difficulty in ascertaining whether any observed divergence from previous trends could be caused by BART. The interesting findings were that in some cities there had been increasing office construction activity around the BART stations. Any further monitoring probably should focus on this impact.

The five locations (downtown San Francisco, Oakland, Richmond, Berkeley, and Walnut Creek) where new offices were found to locate near BART stations should be monitored. Several other station areas (e.g. Bay Fair, San Leandro, Fremont) have the potential for office development, and they may warrant monitoring.

Every two years, aerial photos could be reviewed or local planners interviewed, and indications of new office development near BART tabulated. Office construction for the whole city for each of the five cities where impact has been found should be reviewed either every two years or at the end of five years. At the end of a five-year period, the amount of new office construction in the near-BART areas could be compared to office construction activity in the city as a whole, and changes in the proportion would be evident.

At the time when new office construction is first noticed in an aerial photo, key informant interviews should be conducted, for it would be opportune to

"catch" the developers while the location decision process was still fresh in their minds. These interviews also might double for monitoring employers' location decisions, at least in those instances where the developer is also a major employer. Without knowing the amount of office construction activity that will occur, we only can estimate the number of interviews based on past experience. It would seem that 20 interviews, four at each of the five sites, should be adequate to follow up on new office construction.

Unless the aerial photos indicate that a great deal of office construction is appearing in one of the other BART station areas, the monitoring should be confined to the five locations where some impact has been recorded.

The decision on when to repeat the analysis (after another five or 10 years, or perhaps never) could be made when the results of the first monitoring are in: If no further impact is found, the sponsors of the program may wish to discontinue the research. On the other hand, a flexible approach to timing could be adopted. If the sponsors were interested only in whether BART is having a positive impact on new office construction (as might well be the case), monitoring could be conducted only when a given level of new development in the station areas had been observed. The biannual review of aerial photos would show whether any new office construction had occurred in the station areas. Collection of the office construction data at the city level would be performed only when the new near-BART office construction starts reached some predetermined number (for example, one or two for Walnut Creek, two or three for Berkeley and Richmond, three or four for Oakland and San Francisco) size (in square feet), or value (construction cost shown on the permit). Under this system, the relative office construction activity in the station areas would be determined only when some initial level of activity had been attained.

Housing Construction

Monitoring Method: Review building permits and aerial photos, key informants

Locations: Fremont, Union City, South Hayward, San Leandro-Bay Fair, Pleasant Hill, Richmond, and Walnut Creek (and possibly the outlying areas of Pittsburg-Antioch and Livermore-Pleasanton)

Timing: Every five years, with annual data collection

Priority: Moderate-High

Our findings indicated that BART has provided some impetus to construction of new housing in outlying, suburban communities where BART provides improved accessibility to downtown San Francisco and Oakland. Whether this effect is a short-term phenomenon or marks a long-term trend should be monitored. Housing construction in the communities recommended for continued study

(Fremont, Union City, Hayward, San Leandro, Pleasant Hill, Richmond, Walnut Creek, and Pittsburg-Antioch and Livermore-Pleasanton) should be analyzed annually in terms of their share of suburban housing construction region-wide. For each community, trends should be computed for single family housing and multi-family housing separately.

Around stations in developed urban areas, we found no evidence of intensification of residential use or extensive rehabilitation attributable to BART, so monitoring for these effects should not be given high priority.

Aerial photos should be reviewed on an annual basis to pinpoint housing development near BART stations (this task will provide information on all types of station area development, not just housing). Whenever a new development is noted, interviews with the project proponents should be conducted as soon as possible to find out how important BART was in feasibility analysis and site selection decisions. After the project opens, follow-up interviews should be conducted to see whether BART affected the market response and to determine the proportion of new residents who ride BART.

Local planners in study area communities should be interviewed, possibly on an annual basis, to find out whether any BART-oriented developments are in the planning stages. This will enable those charged with monitoring to schedule key informant interviews in a timely fashion, thus minimizing the problems of bias — asking informants to remember the basis for a decision made years previously.

Speculation

No continued monitoring is recommended due to the limited impacts observed and the tendency for speculative activity to have declined after BART's construction.

Retail Sales — Shopping Patterns

Monitoring Method: Shopper survey

Locations: Downtown San Francisco, downtown Oakland, Walnut Creek (possibly Berkeley, El Cerrito Plaza, Mission District, and other areas)

Timing: Flexible

Priority: Moderate

Our findings show a potential shift in store patronage toward San Francisco, Oakland and Walnut Creek because of BART. In order to determine whether the change materializes, the survey should be revised to detect what are the causes

for the decreased patronage at shopping areas losing customers. The survey should continue to find the proportion of all shoppers who are BART riders, where their patronage has shifted from, and what factors have caused shoppers to begin to shop or to increase the frequency of their shopping at each area. But in order to do this with greater confidence, the sample should contain a larger number of "new" shoppers than did the earlier survey.

The survey should take place in San Francisco, Oakland, and Walnut Creek, since these were the three areas where our results suggest BART impacts. For consistency, or to detect previously unanticipated impacts, it might be good to include the other three sites originally surveyed. There does not appear to be any reason to extend the survey to new locations, except possibly Bay Fair station. The original sample site was 500 people. This might be reduced to 300 in the follow-up survey if only three sites are studied.

Rather than conducting the shopper survey at predetermined intervals, timing of the survey could be contingent upon observed changes in BART use for shopping. The most recent Passenger Profile Survey reports the percent of BART riders at each destination station who are on shopping trips, and the total patronage at each station. Therefore, the average number of BART shoppers at each location is known. If this number increases or decreases beyond, say, 10 to 20 percent of its 1977 level at any of the six shopping districts previously studied or at Bay Fair station, then a new survey should be conducted.

Retail Sales — Sales Data

Monitoring Method: Sales volume trends, regression analysis

Locations: Seventeen sites previously studied (possibly downtown Oakland, San Francisco, and Berkeley only)

Timing: In five to 10 years

Priority: Moderate

To some extent, this analysis would duplicate the shopper survey, since shopping pattern changes should coincide with retail sales changes. However, the sales tax data can be useful (1) in distinguishing the sales of near-BART stores from those of far-from-BART stores within a city, and (2) comparing sales trends of near-BART shopping districts with those of districts that are not served by BART.

There are several options for dealing with the retail sales data.

Locations — The Bucklin sample which was used in the LU&UD Project contains 17 locations.⁸ Again, all locations could be sampled, especially if sales are

8. For details, see John Blayney Associates/David M. Dornbusch & Co., Inc., Study of Retail Sales and Services (April 1978).

compared at only two points in time. Alternatively, the improved aggregations for San Francisco, Berkeley, and Oakland could be viewed alone. In the Ashby station area, retail sales may be monitored quite easily. The City of Berkeley maintains separate retail sales figures annually for different sections of the city. The Adeline area between Ashby and Alcatraz was hard-hit by BART construction. Sales declines during that time were never fully recovered, and it might be well worth the effort to continue to monitor the retail activity in this area to see when and if recovery ever is achieved.

Timing — The California Board of Equalization might be asked to continue to collect the Bucklin sample data on an annual basis; or the trend in sales could be determined by comparing sales in two years at an interval of five to 10 years. There are advantages and disadvantages to both approaches. First, the annual sales collection is more expensive and more cumbersome. However, it does enable a better estimation of trend than does the two-point scheme. On the other hand, collecting the data only at the end of a five to 10 year period would reduce costs, but it might be difficult to keep track of all the sample irregularities (closeouts, changes to non-retail use, etc.). Because the sales tax data would be used largely to corroborate evidence from the shoppers survey, the second approach seems to be reasonable.

The question of when to conduct another sales tax data analysis is a difficult one. Perhaps the most logical time would be when and if patronage changes indicate that sales impacts might be significant in any of the three downtowns — San Francisco, Oakland, or Berkeley. The Board of Equalization ordinarily keeps the data required for analysis for about a year, so it probably would not be difficult to obtain some recent data without giving advance notice.

Sampling — Changes in the sampling procedure originally designed by Bucklin might make the sample more representative. For example, a change to periodic random sampling from the present method of monitoring sales at a given address could solve the extensive problems experienced with sample irregularities. However, a change in the procedure now would destroy comparability with earlier data. Sampling changes should be invoked only if they are instituted for an analysis within the next year; that is, repeated two to three years from now.

Key informant interviews on this topic — BART's effects on retail sales — were not especially productive and need not be repeated.

Property Prices and Rents

Monitoring Method: Key informant interviews, regression analysis of property transactions and rent levels

Locations: Downtown San Francisco, downtown Oakland, El Cerrito Plaza, Rockridge, South Hayward, and Walnut Creek (possibly Glen Park, North Berkeley, Pleasant Hill, and Richmond)

Timing: Every three to five years, with annual data collection

Priority: High

Property prices and rents are some of the best indicators of revealed preferences, the extent to which people value BART's service or are affected by its nuisances such as train noise, visual intrusion, and parking lot overflow. In the LU&UD Project we found both positive and negative effects. These indicators, therefore, should be continuously monitored at selected station areas.

The best method for monitoring property price and rent changes is regression analysis, building on the data base and analytical procedures established in Work Element 13. To secure information on a continuing basis, a cooperative agreement could be negotiated with the Multiple Listing Service to obtain an annual sample of repeat sales within the study areas. Data on residential and commercial rents and lease renewals in the study areas also should be sampled on an annual basis.

Interviews with realtors, appraisers, and others familiar with the local real estate market also should be conducted periodically to identify other influences that might have affected property prices and rents and to identify impacts where the statistical analysis may prove inconclusive. About three to four interviews should be programmed for each study area to obtain several different viewpoints.

All of the sites studied in Work Element 13 should be included in a long-term monitoring program except the Mission District, where no BART impact was found and the neighborhood is undergoing such change that further analysis is unlikely to yield much useful information. With direct service from Richmond to San Francisco, ridership at the Richmond station may increase. If this happens, monitoring property price and rent changes might be warranted.

Development Patterns

Because study of BART's impact on development patterns represents a synthesis of the individual subject area studies, separate monitoring procedures are not recommended. Rather after each monitoring cycle is complete, say every five years, the gains and losses attributable to BART and their interrelationships should be examined. Are any communities gaining at the expense of others? Which socio-economic groups, if any, benefit most from BART? Are community growth trends being affected?

Once the MTC-ABAG regional data base is updated with information from the 1980 census and with 1980 land use data, the regression analysis conducted for Work Element 7 should be repeated to determine whether the interpretation of 1970-75 development trends remains valid. The results of the trial analyses demonstrated distributional changes that are attributable to BART's influence; repetition of this analysis should provide even more definitive answers to questions about BART's distributional effects.

REPORTING

Two types of reports should be produced in a long-term monitoring program. On an annual basis, the principal indicators of BART-related land use changes should be summarized, and significant changes from prior year measures described. These reports need not contain extensive analysis but, instead, should be designed to provide up-to-date, readily accessible information on station area construction, retail sales, and property price and rent changes. Highlights from these reports, in turn, might be included in MTC's annual transit operations reports. Every five years a comprehensive assessment of BART's land use and urban development impacts should be prepared, summarizing and interpreting the data obtained from the monitoring program and making specific policy recommendations.

Workshops for local and regional agency staff could be held periodically to review the findings of the monitoring program, focusing particularly on the effectiveness of local land use policies and programs intended to foster transit-related development. Training planners to use data available from the monitoring program also might improve the quality of station area planning and public improvement programming.

COSTS

To undertake the high and moderate priority work proposed for the long-term monitoring program a budget of \$400,000-470,000, including an allowance for inflation, will be needed for the first five years. This should cover data collection, analysis, and reporting on an annual basis. If only high priority monitoring is to be undertaken, the program should cost about \$255,000 for the first five years. The estimated costs by category, shown in Table 3, are derived from the actual expenditures for similar work in the LU&UD Project, adjusted to reflect economies attributable to building on an existing data base and validated analytical procedures.

A portion of the costs of the Passenger Profile Survey and the aerial photography might be borne by the BART District as part of its normal planning and marketing operations, so the actual amount to be funded might be less than the total estimated. Cost-sharing arrangements also might be negotiated with local communities to secure building permit data.

TABLE 3. ESTIMATED COSTS OF LONG-TERM MONITORING:
FIRST FIVE YEARS (1978 Dollars)

	<u>Professional Time^a (Person-Days)</u>	<u>Estimated Cost Five Year Total</u>
DATA COLLECTION		
*Aerial Photography (every 2 years)	—	\$ 6,000
*Building Permits (annual update)	60	15,000
Surveys		
*BART Passenger Profile (every 2 years)	10-20	45,000
Workplace (once only)	20-40	65-70,000
Shoppers (once only)	10-20	15,000
Retail Sales (17 areas — once only)	10-20	15-20,000
*Property Sales (7 areas — annually)	100	25,000
*Rents (7 areas — annually)	100-150	25-30,000
*Key Informant Interviews (50-100)	50-100	15-25,000
ANALYSIS		
*Annual Screening	50	12,500
Detailed Quantitative Analysis (Priority Impacts Only)	300-500 (200)	75-125,000 (50,000)
REPORTING		
Annual Update	50	12,000
*Five Year Perspective	60	20,000
PROGRAM MANAGEMENT		
Subtotal	870-1220	\$356-418,000
Allowance for Inflation (6%/year)		\$ 44-52,000
Total		\$400-470,000
(High Priority Impacts Only)		(\$255,000)

*High Priority Monitoring Methods

- a. Includes professional time for lead agency/contractor, but excludes interviewer/technician time of specialized subcontractors needed for survey research, aerial photography, or retail sales data collection.

Source: John Blayney Associates, David M. Dornbusch & Co., Inc.

LAND USE AND URBAN DEVELOPMENT PROJECT DOCUMENTATION

Following is a list of reports prepared for the Land Use and Urban Development Project, organized by impact category. Except for working notes — informal documentation of methodology and preliminary findings — these reports are available through the National Technical Information Service, Springfield, Virginia 22151. Working notes are available at the offices of the Metropolitan Transportation Commission. Report numbers are indicated.¹

Research Plan

1. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study Design and Project Implementation Plan**, Planning Document, Document No. DOT-BIP-PD-27-5-77, Berkeley: Metropolitan Transportation Commission, March 1977.

Impact Category: BART's Consumption of Land and Property

2. John Blayney Associates/David M. Dornbusch & Co., Inc., **BART's Consumption of Land and Property**, Working Paper, Document No. DOT-BIP-WP-55-5-78, Berkeley: Metropolitan Transportation Commission, March 1978.

Impact Category: BART's Construction Impacts

3. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of BART's Construction Impacts**, Working Paper, Document No. DOT-BIP-WP-48-5-78, Berkeley: Metropolitan Transportation Commission, April 1978.

Impact Category: Accessibility Mapping

4. John Blayney Associates, **Procedures for Accessibility Mapping**, Working Note, Berkeley: Metropolitan Transportation Commission, March 1977.
5. John Blayney Associates/David M. Dornbusch & Co., Inc., **Accessibility Mapping**, Working Paper, Document No. DOT-BIP-WP-36-5-77, Berkeley: Metropolitan Transportation Commission, March 1977.

Impact Category: Station Area Land Use

6. John Blayney Associates/David M. Dornbusch & Co., Inc., **Station Area Land Use**, Working Paper, Document No. DOT-BIP-WP-39-5-77, Berkeley: Metropolitan Transportation Commission, November 1977. Prepared as part of the documentation for the Land Use and Urban Development Project.

1. DOT = Department of Transportation; BIP = BART Impact Program; FR = Final Report; WP = Working Paper; PD = Planning Document.

Impact Category: Workers' Location Decisions

7. Tyler Research Associates, **Work Element 4 Survey Methodology**, Working Note, Berkeley: Metropolitan Transportation Commission, June 1977.
8. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Workers' Location Decisions**, Working Paper, Document No. DOT-BIP-WP-38-5-77, Berkeley: Metropolitan Transportation Commission, November 1977.

Impact Category: Households' Location Decisions

9. Tyler Research Associates, **Work Element 3 Survey Methodology**, Working Note, Berkeley: Metropolitan Transportation Commission, September 1977.
10. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Households' Location Decisions**, Working Paper, Document No. DOT-BIP-WP-47-5-78, Berkeley: Metropolitan Transportation Commission, February 1978.

Impact Category: Employers' Location Decisions

11. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Employers' Location Decisions**, Working Paper, Document No. DOT-BIP-WP-46-5-78, Berkeley: Metropolitan Transportation Commission, March 1978.

Impact Category: Office Construction Industry

12. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of the Office Construction Industry**, Working Paper, Document No. DOT-BIP-WP-33-5-77, Berkeley: Metropolitan Transportation Commission, August 1977.

Impact Category: Housing Industry

13. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of the Housing Industry**, Working Paper, Document No. DOT-BIP-PD-37-5-77, Berkeley: Metropolitan Transportation Commission, September 1977.

Impact Category: Property Acquisition and Occupancy (Speculation)

14. David M. Dornbusch & Co., Inc., **Work Element 14 Methodology**, Working Note, Berkeley: Metropolitan Transportation Commission, July 1977.
15. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Property Acquisition and Occupancy: BART's Effect on Speculation**, Working Paper, Document No. DOT-BIP-WP-45-5-78, Berkeley: Metropolitan Transportation Commission, April 1978.

Impact Category: Retail Sales and Services

16. David M. Dornbusch & Co., Inc., **Work Element 9 Methodology**, Working Note, Berkeley: Metropolitan Transportation Commission, October 1977.
17. Tyler Research Associates, **Survey Methodology for Study of Shopping Location Decisions**, Working Note, Berkeley: Metropolitan Transportation Commission, January 1978.
18. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Retail Sales and Services**, Working Paper, Document No. DOT-BIP-WP-50-5-78, Berkeley: Metropolitan Transportation Commission, April 1978.

Impact Category: Property Values and Rents

19. David M. Dornbusch & Co., Inc., **Work Element 13 Methodology**, Working Note, Berkeley: Metropolitan Transportation Commission, July 1977.
20. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Property Values and Rents**, Working Paper, Document No. DOT-BIP-WP-52-5-78, Berkeley, Metropolitan Transportation Commission, July 1978.

Impact Category: Development Patterns

21. John Blayney Associates/David M. Dornbusch & Co., Inc., **Methodology: Study of Development Patterns**, Working Note, Berkeley: Metropolitan Transportation Commission, July 1977.
22. John Blayney Associates/David M. Dornbusch & Co., Inc., **Study of Development Patterns**, Working Paper, Document No. DOT-BIP-WP-51-5-78, Berkeley: Metropolitan Transportation Commission, June 1978.

Impact Category: Program-Wide Case Studies

23. John Blayney Associates/David M. Dornbusch & Co., Inc., **Methodology: Program-Wide Case Studies**, Working Note, Berkeley: Metropolitan Transportation Commission, July 1977.
24. John Blayney Associates/David M. Dornbusch & Co., **Program-Wide Case Studies: Findings to Date**, Working Note, Berkeley: Metropolitan Transportation Commission, December 1977.
25. John Blayney Associates/David M. Dornbusch & Co., Inc., **Program-Wide Case Studies**, Working Paper, Document No. DOT-BIP-WP-53-5-78, Berkeley: Metropolitan Transportation Commission, July 1978.

Long-Term Monitoring

26. John Blayney Associates/David M. Dornbusch & Co., Inc., **Recommendations for Long-Term Monitoring**, Working Paper, Document No. DOT-BIP-WP-54-5-78, Berkeley: Metropolitan Transportation Commission, July 1978.

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